

# The Lichen Genus *Cladonia* Section *Cocciferae* in Australia

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Eight species of *Cladonia* Hill ex Browne sect. *Cocciferae* (Delise) Dahl occur in Australia. *C. angustata* Nyl. is reported for the first time in Australia. A key to the species is presented and the major phenolic compounds of each taxon are reported.

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KEY WORDS: *Cladonia angustata* Nyl., *Cladonia bimberiensis* A. W. Archer, *Cladonia floerkeana* (Fr.) Flörke, *Cladonia macilenta* Hoffm., *Cladonia murrayi* W. Martin, *Cladonia pleurota* (Flörke) Schaerer, *Cladonia subdigitata* Nyl., *Cladonia weymouthii* F. Wilson ex A. W. Archer, lichens, *Cocciferae*, *Ochroleucae*, chemotaxonomy, distribution, Australian lichens.

## INTRODUCTION

The lichen genus *Cladonia* Hill ex Browne contains about 350 species (Ahti, 1982) and of these 53 are thought to occur in Australia. This paper describes the Australian species that form the section *Cocciferae* (Delise) Dahl, including the group *Ochroleucae* (Dahl, 1952). The study is based on an examination of relevant type specimens (indicated by !), specimens from Australian herbaria, Australian specimens in the British Museum (Natural History) (BM) and the University of Helsinki (H), and the author's own collections. No previous publication has dealt with this group of lichens in Australia but a recent paper (Stenroos, 1986) has described section *Cocciferae* from Melanesia, including Papua New Guinea. The following sixteen taxa of *Cladonia* sect. *Cocciferae* have previously been reported from Australia: *C. bacillaris* Nyl. (Watts, 1903), *C. bimberiensis* A. W. Archer (Archer, 1985), *C. coccifera* (L.) Willd. as *Cenomyce coccifera* (Brown, 1814), *C. corallifera* (Kunze) Nyl. (Krempelhuber, 1880), *C. cornucopioides* (L.) Hoffm. (Leighton, 1867), *C. deformis* (L.) Hoffm. as *Cenomyce deformis* (Brown, 1814), *C. didyma* (Fee) Vainio (Vainio, 1887: 139), *C. digitata* (Leighton, 1867), *C. flabelliformis* Vainio (Vainio, 1887: 116), *C. floerkeana* (Fr.) Flörke (Krempelhuber, 1880), *C. macilenta* Hoffm. (Krempelhuber, 1880), *C. murrayi* W. Martin as *Cenomyce firma* (Laurer, 1827), *C. muscigena* Eschw. (Krempelhuber, 1880), *C. pleurota* (Flörke) Schaerer as *C. coccifera* var. *pleurota* (Vainio, 1887: 170), *C. subdigitata* Nyl. (Vainio, 1887: 181) and *C. weymouthii* F. Wilson ex A. W. Archer (Archer, 1985). Several of these reports are not valid and are probably based on misidentifications of other species; eight species in Section *Cocciferae* are here reported to occur in Australia. A description of each species is given together with its chemistry and distribution.

## SYSTEMATICS AND DISCUSSION

### *Cladonia* sect. *Cocciferae* (Delise) Dahl

*Rev. Bryol. Lichenol.* 21: 121 (1952) *Cenomyce* [rankless] *Cocciferae* Delise in Duby, *Bot. gall.* 2: 632 (1830).

Podetia scyphose or escyphose, simple or slightly branched, often sorediate. Apothecia red, containing rhodocladonic acid, or pale brown. The major phenolic

compounds are usnic, iso-usnic, thamnolic, barbatic, didymic, and squamatic acids; the yellow pigment skyrin and the triterpene zeorin may also be present.

KEY to the species of *Cladonia* sect. *Cocciferae* in Australia

1. Podetia escyphose . . . . . 2
1. Podetia scyphose . . . . . 6
2. Usnic acid present . . . . . 3
2. Usnic acid absent . . . . . 4
3. Podetia with variable soredia; didymic acid present . . . . . *C. angustata*
3. Podetia with dense farinose soredia; didymic acid absent . . . . . *C. bimberiensis*
4. Podetia corticate, or partly corticate and granular sorediate . . . . . *C. floerkeana*
4. Podetia partly corticate and farinose sorediate . . . . . 5
5. Podetia corticate only at base and just below apothecia; apothecia common; usually less than 25mm tall . . . . . *C. macilenta*
5. Podetia partly corticate, the cortex often covering the lower third of the podetia; apothecia rare; usually more than 30mm tall . . . . . *C. weymouthii*
6. Podetia Pd-, thamnolic acid absent; apothecia rare . . . . . *C. pleurota*
6. Podetia Pd+ yellow, thamnolic acid present; apothecia common . . . . . 7
7. Usnic acid absent; basal squamules conspicuous, podetia green, growing on soil . . . . . *C. murrayi*
7. Usnic acid present; basal squamules inconspicuous, podetia yellow, growing on wood . . . . . *C. subdigitata*

*Cladonia angustata* Nyl., *Ann. Sci. Nat. Bot. sér. 4*, 11: 236 (1859). *Cladonia cornucopioides* var. *angustata* Nyl., *Mém. Soc. Sci. Nat. Cherbourg* 5: 96 (1858 ('1857')), nom. nud.

*Type*: Iles Sandwich (Hawaii), J. Remy 1851-1855; lectotype: H-NYL 37978!; isolectotype: PC.

*Description*: Basal squamules evanescent or persistent, 1 × 1.5mm, lacinate or crenate, esorediate, yellowish-green above, white below. Podetia growing from the basal squamules, 5-10mm tall, 0.5-1.0mm diam., escyphose, simple or rarely branching, apices obtuse or sub-acute, the basal area corticate, the remainder ecorticate and sorediate, soredia farinose to granular, cortex sub-continuous or areolate. Apothecia red, terminal.

*Chemistry*: K+ yellow or K-, KC+ yellow, P+ yellow or P-. Usnic and didymic acids ± thamnolic ± barbatic acids.

The well-defined basal corticate area on the podetia and the presence of usnic and didymic acids together, distinguish this species from other Australian taxa in the group *Cocciferae*. Mature apothecia were not seen in Australian specimens.

*Distribution*: *Cladonia angustata* is an uncommon but widely distributed species in Western Australia, Queensland and Tasmania where it grows on dead wood or sandy peat. It also occurs in New Zealand, Japan and Hawaii.

*Representative specimens*: Western Australia: Busselton, Layman Rd, near Wonnerup House, 31.xii.1981, N. Sammy (PERTH 820560); Porongrup National Park, near summit of Nancy Peak, 7.vii.1968, N. Sammy (PERTH 840899); Jarrahdale, 50km SE of Perth, 9.vi.1973, N. Sammy (PERTH 840934). Queensland: Wybara, 9km NW of Wallanagara, H. Streimann 9829 (CBG). Tasmania: Mawbanna Plain, 15km SE of Stanley, G. Kantvilas 1.iv.1985 (H).

*Cladonia bimberiensis* A. W. Archer, *Muelleria* 6: 93 (1985).

*Type*: Mt Bimberi, 49km SW of Canberra, A.C.T., H. Streimann 9743; holotype: CBG!; isotype: H!, US.

*Description*: Basal squamules persistent, 0.5-1.0mm long, 0.3-0.5mm wide, esorediate, yellow-green above, white below, margins crenate. Podetia growing from the basal squamules, 10-30mm tall, 0.7-2.0mm diam., pale yellow, more or less cylindrical, simple and escyphose, or with shallow, deformed scyphi with marginal proliferations; podetia rough corticate at the base and then becoming ecorticate and densely farinose sorediate, with the interior of the scyphi farinose sorediate; esquamulose or occasionally with squamules on the lower part of the podetia. Apothecia not seen; pycnidia subconical, brown, 0.1-0.2mm diam., 0.3-0.4mm long, terminal or marginal on the scyphi; conidia not seen.

*Chemistry*: K-, KC+ yellow, P-. Usnic, barbatic and 4-0-demethyl barbatic acids.

*C. bimberiensis* is distinguished from *C. macilenta* and *C. corniculata*, by the yellow colour and the K- and P- reactions, and from *C. angustata* by the branched podetia and the absence of didymic acid.

*Distribution*: *Cladonia bimberiensis* is an uncommon alpine to subalpine species found in Victoria, the Australian Capital Territory and Tasmania where it grows on dead wood. It also occurs in the South Island of New Zealand.

*Representative specimens*: Australian Capital Territory: SE of Bimberi Park, Bimberi Range, J. A. Elix 6640 (ANUC, MEL 1047742); *ibid.* J. A. Elix 6639 (NSW); Mt Franklin, A. Archer 1900 (ANUC, H, NSW). Victoria: track to Mt Stirling summit, A. Archer 2058 (NSW). Tasmania: North East Great Lake, G. Bratt 564 (BM).

*Cladonia floerkeana* (Fr.) Flörke, *Clad. Comment.* 99 (1828). ('*Floerkiana*').

*Cenomyce floerkeana* Fr., *Lich. Suec. Exsic.* 82 (1824).

*Type*: not designated.

*Description*: Basal squamules small, inconspicuous, 0.5-1 × 1-2mm slightly lobed. Podetia growing from the basal squamules, simple or sparingly branched near the apices, escyphose, sterile podetia subulate, 5-20 (rarely to 25)mm tall, 0.5-1 (rarely to 2)mm diam., the major part of the podetia and the area below apothecia corticate, the cortex scabrose to sub-verrucose, the remainder ecorticate and minutely squamulose or granular sorediate, or the podetia completely corticate. Apothecia common, red, convex, terminal, 1-2mm diam.

*Chemistry*: K+ yellow or K-, KC-, P+ yellow or P-. Barbatic and didymic acids ± thamnolic acid.

*Cladonia floerkeana* is a widely distributed and, when fertile, conspicuous species in Eastern Australia, distinguished from *Cladonia macilenta* by the predominantly corticate podetia and the absence of farinose soredia. In contrast to specimens from the Northern Hemisphere the Australian specimens often contain thamnolic acid.

*Distribution*: *Cladonia floerkeana* is a cosmopolitan species growing on dead or burnt wood or on soil. It occurs in eastern Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia and Tasmania, and also on Norfolk Island.

*Representative specimens*: South Australia: Mt Lofty Range, 5.x.1971, D. Whibley 3678 (AD 97647213). Queensland: 1km S of Herberton, J. Elix 16614 (ANUC). New South Wales: 25km E of Braidwood, 15.xi.1970, E. Dahl (CANB 227864); near Yeomans Bay, ca 30km N of Sydney, 30.iii.1985, A. Archer 1741 (H, NSW). Australian Capital Territory: Jervis Bay, H. Streimann 3574 (GBG, H). Victoria: near Beaconsfield, G. Bratt 69/611 (HO 53117). Tasmania: Churchill Spur, Florentine River, G. Bratt 68/237 (HO 53877). Norfolk Island: J. & T. Gilbert, s.n. (HO 53167).

*Cladonia macilenta* Hoffm. *Deutschl. Fl.* 2: 126 (1796).

*Type*: not designated.

*Cladonia bacillaris* Nyl., *Not. Sällsk. Fauna Fl. Fenn. Förh.* 8: 179 (1866).

*Type*: not designated.

*Description*: Basal squamules small, inconspicuous, 0.5 × 1mm, margins ± soredia. Podetia growing from the basal squamules, simple or rarely branching near the apices, escyphose, pale green, 10-20 (rarely to 30)mm tall, 0.5-1.5mm diam., the major part of the podetia ecorticate and farinose sorediate apart from short, smooth corticate areas at the base and below the apothecia; sterile podetia blunt or subulate; rarely squamulose on the basal corticate area. Apothecia red, convex, terminal, 0.5-2mm diam.

*Chemistry*: K+ yellow or K-, KC-, P+ yellow or P-. Barbatic, ± didymic ± thamnolic acids or rarely squamatic and consquamatic acids.

*Cladonia macilenta* is distinguished from *Cladonia weymouthii* by the short, rarely branched podetia and the small corticate area at the base of the podetia. It is distinguished from *Cladonia floerkeana* by the conspicuously ecorticate and farinose sorediate podetia. The exact status of *Cladonia bacillaris* as a separate species is unclear (Ahti, 1980). Christensen (1987) has recently suggested that *Cladonia bacillaris* is merely a thamnolic acid deficient form of *Cladonia macilenta*. However, in Australia specimens lacking thamnolic acid are uncommon and squamatic acid has only been found in one specimen from Victoria.

*Distribution*: *Cladonia macilenta* is a cosmopolitan species growing on dead wood or on soil. It occurs in south western Western Australia, eastern Queensland, New South Wales, Australian Capital Territory, and Victoria.

*Representative specimens*: With thamnolic acid: Western Australia: Porongorups National Park, 15.x.1980, N. Sammy (PERTH 810103). Queensland: Tinnaroo Falls Rd, 12km NE of Atherton, J. Elix 16584 (ANUC). New South Wales: Clyde Mtn, 8.xii.1974, J. Elix (ANUC, MEL 1017163); Bolivia Hill, near Deepwater, 23.i.1980, H. Streimann 9953 (CBG 8002514, H). Victoria: near Moondarra, G. Bratt 76/509 (HO 52909).

Lacking thamnolic acid: New South Wales: South Tinderry Peak, 22.iii.1970, E. Dahl (CANB 227672); Mt Banks, 9.iii.1985, A. Archer 1736 (NSW); near Frederica Falls, Lawson, 27.vi.1987, A. Archer 2115 (NSW). Australian Capital Territory: near Honeysuckle Creek Tracking Station, 2.iv.1983, A. Archer 1483 (NSW).

With squamatic acid: Victoria: by the side of Buller Creek, Mirimbula, 5.xi.1986, A. Archer 2049 (H, NSW).

*Cladonia murrayi* W. Martin, *Trans Roy. Soc. N.Z., Bot.* 2: 40 (1962).

*Type*: Secretary Island, Doubtful Sound, West Otago, New Zealand, Feb. 1959, J. Murray; holotype: CHR 257075!; isotype: BM!.

*Cenomyce firma* Laurer, *Linnaea* 2: 44 (1827); *Cladonia firma* (Laurer) Krempelch., *Verh. zool.-bot. Ges. Wien*, 18: 309 (1868), nom. illeg.;

*Cladonia firma* (Laurer) Vainio, *Acta Soc. Fauna Flora fenn.* 4: 215 (1887), nom. inval., non *Cladonia firma* (Nyl.) Nyl., *Bot. Ztg.* 47: 352 (1861).

*Type*: New Holland, F. Sieber, sin. loc. [?Tasmania]; holotype: G!.

*Description*: Basal squamules persistent, conspicuous, 1-2mm wide, 3-6mm long, incised, esorediate, the lower surface becoming yellow to yellow-brown in the older parts. Podetia growing from the squamules, 1-2.5cm tall, 1-3mm diam., green or greyish-green, scyphose or with deformed scyphi, with short (2-4mm) proliferations bearing apothecia, corticate, verrucose to scaly, becoming ecorticate and squamulose, esorediate. Apothecia conspicuous, red, 1-3 (rarely to 5)mm diam.

*Chemistry*: K+ yellow, KC-, P+ yellow. Thamnolic acid and skyrin (rhodophyscin).

*Cladonia murrayi* is a terricolous, corticate, green, scyphose species with conspicuous red apothecia. It is distinguished from *Cladonia subdigitata* by the green scyphi and the absence of usnic acid. The exact origin of the type specimen of *Cenomyce firma* is unclear. The Austrian collector Franz Sieber collected in New South Wales (Audas, 1950: 21) but did not visit Tasmania (Kantvilas, 1983). Recent collections of *Cladonia murrayi* have been made only in Tasmania and New Zealand and no specimens are known from New South Wales. Herbarium specimens labelled *Cladonia murrayi* from Mt Wilhelm, New Guinea (R. Hnatiuk and E. Dahl, 26.viii.1970) lacked thamnolic acid and skyrin and are identified as *Cladonia pseudodigitata* Gyeln. (CANB 227807) and *Cladonia yunnana* (Vainio) des Abb. (CANB 227808).

*Distribution:* *Cladonia murrayi* occurs in Tasmania, growing on moist soil in semi-shaded positions, with *Cladia aggregata* (Sw.) Nyl. and *Siphula decumbens* Nyl. It also occurs in New Zealand.

*Representative specimens:* Tasmania: Ben Lomond, May 1887, Dr Bamford (NSW); near summit of Mt Murchison, Dec 1893, Fitzgerald (NSW); Lake Dobson, Mt Field National Park, G. Kantvilas 613/81 (BM); Great Dome, Dennison Range, G. Kantvilas 778/81 (BM); W side of Lake Dove, 30.xi.1983, A. Archer 1562A (H, NSW); 8km from Lake Dobson, G. Bratt 70/303 (HO 56284).

*Cladonia pleurota* (Flörke) Schaerer, *Enum. lich. eur.*: 186 (1850).

*Capitularia pleurota* Flörke, *Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk.* 2: 218 (1808); *Cladonia coccifera* var. *pleurota* (Flörke) Schaerer, *Lich. helv. spic.*: 25 (1823).

*Type:* not designated.

*Cladonia cornucopioides* var. *grandis* Krempelh., *Verh. zool.-bot. Ges. Wien* 30: 332 (1881).

*Type:* Mt Ellery, Gippsland, Victoria, 1870, C. Walter; holo: M!

*Description:* Basal squamules persistent or evanescent, inconspicuous, 1-2mm wide, 2-4mm long, irregularly crenate to lobate. Podetia growing from the basal squamules, simple, scyphose, scyphi 1-4cm tall, 4-10mm diam, with marginal proliferations with apothecia, or in the form of scyphi; the interior of the scyphi ecorticate with granular soredia or tiny flattened corticate scales; the base of the podetia corticate, the cortex continuous or areolate, becoming verrucose and scaly to subsquamulose, finally ecorticate and granular sorediate in the upper parts. Apothecia red, convex, 1-3mm diam, solitary or clustered on the margins of the scyphi, or pedicellate on the margins of the scyphi, rarely seen in Australian specimens.

*Chemistry:* K-, KC+ yellow, P-, Usnic and iso-usnic acids and zeorin.

*Cladonia pleurota* is a common scyphose species and was one of the first *Cladonia* species collected in Australia by Robert Brown (Crombie, 1880). The presence of iso-usnic acid and the partly corticate scyphi distinguish *C. pleurota* from all other Australian species of *Cladonia* whilst the absence of minutely farinose soredia differentiates it from *C. deformis*. Specimens from Tasmania are often 2-4cm tall.

*Distribution:* *Cladonia pleurota* is a widely distributed species found on soil in all Australian states except South Australia. It also occurs on Macquarie Island and in New Zealand, Europe, North America and Japan.

*Representative specimens:* Western Australia: Porongorups National Park, 18.x.1980, N. Sammy (PERTH 810019). New South Wales: South Tinderry Peak, 22.iii.1970, E. Dahl (CANB 227853); 2km NE of Mt Kosciusko, 14.iii.1979, H. Streimann 7631 (CBG 7907333, H, US). Australian Capital Territory: Black Mountain, 30.vii.1975, B. Hain 40 (CBG 8004587). Victoria: Mt Buffalo, 14.xi.1979, A. Archer 830 (H). Tasmania: Mons Tabulans [Mt Wellington] R. Brown 530 (BM); Arthurs Pass, G. Bratt 72/1810

(HO 53142). Macquarie Island: 1 mile N of Bauer Bay, 28.i.1964, R. Filson 5812 (MEL 20278).

*Cladonia subdigitata* Nyl., *C. r. hebd. Séanc. Acad. Sci.*, Paris 83: 88 (1876).

*Type*: Campbell Is, New Zealand, 1874, Filhol; lectotype: H-NYL 37858! (T. Ahti, in litt.); isolectotype: MEL!; syntypes: BM!, PC, TUR-V 14155, 14157, n.v.

*Cladonia corallifera* (Kunze) Nyl. subsp. *subdigitata* Vainio, *Acta Soc. Fauna Flora fenn.* 4: 180 (1887).

*Type*: not designated.

*Cladonia deformis* (L.) Hoffm. var. *tasmanica* Krempelh., *Verh. zool.-bot. Ges. Wien* 30: 332 (1881).

*Type*: Tasmania, J. v. B. Gulliver [T. & B. Gulliver]; holotype: M!; isotype: MEL!.

*Description*: Basal squamules pale yellow, persistent, inconspicuous, 1-3 × 1-3mm, subpalmate, margins crenate, esorediate. Podetia growing from the basal squamules, yellow, simple, scyphose, widening gradually from the base, 1.5-3.0 (rarely to 5.0)cm tall, 1.5-4mm diam., corticate at the base, becoming scaly or rough or minutely squamulose, corticate below apothecia, scyphi 3-5 (rarely to 8)mm diam., interior corticate, closed, or open in older specimens, with marginal scyphi or apothecia. Apothecia red, conspicuous, common, convex, 1-4mm diam., marginal on the scyphi or on corticate proliferations from the margins of the scyphi.

*Chemistry*: K+ yellow, KC+ yellow, P+ yellow. Usnic and thamnolic acids ± skyrin.

*Cladonia subdigitata* is distinguished from all other Australian scyphose *Cladonia* by the yellow scyphi with conspicuous red apothecia and the presence of thamnolic acid. This taxon is often misidentified as *Cladonia coccifera* (L.) Willd. on herbaria labels.

*Distribution*: *Cladonia subdigitata* is a conspicuous, scyphose species growing on dead wood. It occurs in Tasmania and rarely in Victoria, and has been reported from the Grampians, Victoria (Vainio, 1887) and from Papua New Guinea (Mattick, 1942) but this last report was not confirmed (Stenroos, 1986). It also occurs on Macquarie Island and in New Zealand.

*Representative specimens*: Victoria: Lake Tyers, Feb. 1888, F. Wilson (NSW); Mt Macedon, R. Filson 12041 (MEL 39956). Tasmania: Mt Dromedary, June 1895, L. Rodway (NSW); Federation Peak, Jan. 1949, J. Béchervaise (MEL 7106); Mt Mueller, G. Bratt 73/121 (HO 44688); Mt Hartz, G. Bratt 3083 (HO 44721); Lake Fenton, G. Bratt 461 (HO 56247). Macquarie Island: 1 mile N of Bauer Bay, 28.i.1964, R. Filson 5832 (MEL 20277).

*Cladonia weymouthii* F. Wilson ex A. W. Archer, *Muelleria* 6: 94 (1985).

*Type*: Huon River, Tasmania, 5 Feb. 1892, W. A. Weymouth; holotype: MEL 6760!; isotype: NSW!.

*Cladonia cornucopioides* L. f. *arrosa* F. Wilson, *Pap. Proc. Roy. Soc. Tasm.* 1892-3: 151 (1893).

*Type*: Brown's Track, Mt Wellington, Tasmania, F. Wilson, no date; holotype: NSW L4388!.

*Description*: Basal squamules inconspicuous, persistent, 0.5-1mm wide, 1-2mm long, incised, esorediate, margins crenate. Podetia arising from the basal squamules, 1.5-5.0cm tall, 1-4mm diam., green to greenish-grey, subcylindrical or tapering to the apices, simple or branching somewhat near the tips, the branching forming deformed scyphi, lacking well-defined scyphi, axils closed; podetia corticate at the base and for one third of the length of the podetia, and below the apothecia, the remainder of the podetia ecorticate and densely farinose soresediate; podetia esquamulose or with squamules on the lower part. Apothecia rare, terminal, red, convex, 1-3mm diam.

*Chemistry*: K- or K+ yellow, KC-, P- or P+ yellow. Thamnic, barbatic and didymic acids; thamnic and/or didymic acids may be absent.

*Cladonia weymouthii* resembles *Cladonia macilenta* but is distinguished from that species by the occasional deformed scyphi and the tall, branched, partly corticate podetia. It is distinguished from *Cladonia corniculata* by the absence of fumarprotocetraric acid.

*Distribution*: *Cladonia weymouthii* is an uncommon species growing on dead or decayed wood. In Australia it is known only from Tasmania, at altitudes from 250m to 1800m. It also occurs in New Zealand, Papua New Guinea and the Solomon Islands.

*Representative specimens*: Tasmania: Price's Rivulet, Huon, Feb. 1902, W. A. Weymouth (NSW); near Hastings Cave, 27.xi.1982, A. Archer 1417D (H, MEL 1045447); 15km W of Maydena, 7.xii.1983, A. Archer 1545A (CBG, NSW); Pencil Pine Creek, 29.xi.1983, A. Archer 1566A (MEL 1045448); the Hermit, 8km SE of Strathgordon, 19.i.1984, G. Kantvilas 59/84 (NSW); Mt Wellington, J. Townrow 34 (HO 54026).

#### EXCLUDED AND DOUBTFUL SPECIES

*Cladonia bacillaris* Nyl.

The status of *C. bacillaris* as a separate species has been discussed by Ahti (1980), Ahti and Stenroos (1986) and Christensen (1987); following Christensen, *C. bacillaris* is here included in *C. macilenta*.

*Cladonia coccifera* (L.) Willd. em. Asah. *Fl. berol. Prod.*: 361 (1787).

*Lichen cocciferus* L., *Sp. pl.*: 1151 (1753).

*C. coccifera* usually contains usnic and barbatic acids. Although reported to occur in Australia (Krempelhuber, 1880; Vainio, 1887: 154) no specimens corresponding to *C. coccifera* have been found. Australian specimens in herbaria labelled '*C. coccifera*' are often fertile *C. subdigitata* but specimens of *C. murrayi*, *C. pleurota* and *C. merochlorophaea* Asah. have also been identified as *C. coccifera*.

*Cladonia corallifera* (Kunze) Nyl. *Flora*, Jena 57: 70 (1874).

*Genomyce corallifera* Kunze, printed herbarium label with description (?1827).

*C. corallifera*, a scyphose species containing usnic, thamnic and didymic acids, is primarily a lowland Amazonian species from South America (Ahti and Stenroos, 1986). The reported occurrence in Australia is probably based on a misidentification of *C. subdigitata*, which lacks didymic acid.

*Cladonia cornucopioides* (L.) Hoffm. *Deutsch. Fl.* 2: 128 (1796).

*Lichen cornucopioides* L., *Sp. pl.* 1151 (1753).

*C. cornucopioides* is a later synonym of *C. coccifera* (Vainio, 1887: 149). *C. cornucopioides* var. *grandis* Krempelhub. (Krempelhuber, 1881) from Victoria was found to be *C. pleurota* (Acher, 1986b). *C. cornucopioides* f. *arrosa* (Wilson, 1893) from Mt Wellington, Tasmania, NSW L4388, contained only thamnic acid and is *Cladonia weymouthii*, vide supra.

*Cladonia deformis* (L.) Hoffm. *Deutsch. Fl.* 2: 120 (1796).

*Lichen deformis* L., *Sp. pl.*: 1152 (1753).

*Cladonia deformis* is morphologically similar to *C. pleurota* and both taxa contain usnic and iso-usnic acids and zeorin. Australian specimens identified as *C. deformis*, including the early collection by R. Brown from Tasmania, lack the minutely farinose soredia characteristic of this taxon and these specimens are now referred to *C. pleurota*. No Australian material resembling northern hemisphere specimens of *C. deformis* has

been found among the specimens examined. *C. deformis* var. *tasmanica* Krempelh. was referred to *C. subdigitata* (Archer, 1986b).

*Cladonia didyma* (Fée) Vainio. *Acta Soc. Fauna Flora fenn.* 4: 137 (1887).

*Scyphophorus didymus* Fée, *Essai Crypt.*: CI (1825).

*C. didyma*, containing thamnolic, barbatic and didymic acids, is a widely distributed pan-tropical to pan-temperate species; the total distribution was recently reported to include Australia (Stenroos, 1986). This record was based on the inclusion of *C. didyma* in a tentative Key to Australian *Cladonia* (Archer, 1986a). A re-examination of Australian specimens determined as *C. didyma* has shown that they lack the ecorctate squamulose podetia characteristic of *C. didyma* so they are now included in *C. floerkeana*.

*Cladonia digitata* (L.) Hoffm. *Deutsch. Fl.* 2: 124 (1796).

*Lichen digitatus* L., *Sp. pl.*: 1152 (1753).

*C. digitata* is a scyphose species, with conspicuous basal squamules and containing thamnolic acid, found in Europe, North America and Japan. No material corresponding to *C. digitata* has been found amongst the collections examined in Australian herbaria. The records of *C. digitata* from Australia are probably based on misidentifications of *C. subdigitata*, which contains usnic acid. The detailed description of '*C. digitata*' provided by Wilson (1893) based on material from Mt Wellington, Tasmania could equally refer to *C. subdigitata*. A specimen with conspicuous basal squamules and labelled *C. digitata* from Sandringham, Victoria (NSW) contained atranorin and fumarprotocetraric acid and has been identified as *C. praeterrmissa* A. W. Archer. A second scyphose specimen, labelled '*Cladonia digitata*' from Waterfall, Tasmania (NSW) contains usnic and thamnolic acids and is identified as *Cladonia subdigitata*.

*Cladonia flabelliformis* Vainio. *Acta Soc. Fauna Flora fenn.* 4: 113 (1887).

*C. flabelliformis* is a later name for *C. polydactyla* (Flörke) Sprengel (Ahti, 1978). It is a sorediate, scyphose species containing thamnolic acid, which is widespread in western Europe (Tonsberg and Ahti, 1980). The Australian record is probably based on a misidentification of *C. subdigitata* as no specimens from Australia have been found corresponding to *C. polydactyla*.

*Cladonia muscigena* Eschw. *In Martius, Fl. Bras.* 1 (1): 262 (1833).

The type material of *C. muscigena* was collected in Brazil but the exact status of the species is uncertain (Stenroos, 1986). Vainio (1887) considered *C. muscigena* to be a variety of *C. didyma* and it is possible that the first and only report of *C. muscigena* from Australia was based on a misidentification of *C. floerkeana*. It is possible that the reports of *C. muscigena* occurring in New Caledonia are also based on misidentifications of *C. floerkeana* (Stenroos, 1986).

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